

AFRL-SR-AR-TR-02-0178
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Acquisition of a Nanometer-scale Auger Electron Spectroscopy Analytical Microprobe

F49620-00-1-0247



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Air Force Research Laboratory
Air Force Office of Scientific Research
Arlington, Virginia

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REPORT DOCUMENTATION PAGE

AFRL-SR-AR-TR-02-

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|---|-------------|----------------------------------|----------------------------|--|---|
| 1. REPORT DATE (DD-MM-YYYY) 25-03-2002 | | 2. REPORT DATE March 25, 2002 | | 3. DATES COVERED (From - To) April 1, 2000-Sept. 30, 2001 | |
| 4. TITLE AND SUBTITLE Acquisition of a Nanometer-scale Auger Electron Spectroscopy Analytical Microprobe. | | | | 5a. CONTRACT NUMBER | |
| | | | | 5b. GRANT NUMBER F49620-00-1-0247 | |
| | | | | 5c. PROGRAM ELEMENT NUMBER NI/DURIP | |
| | | | | 5d. PROJECT NUMBER | |
| 6. AUTHOR(S) Leonard J. Brillson | | | | 5e. TASK NUMBER | |
| | | | | 5f. WORK UNIT NUMBER | |
| | | | | | |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) The Ohio State University Research Foundation 1960 Kenny Road Columbus, Ohio 43210 | | | | 8. PERFORMING ORGANIZATION REPORT NUMBER Final Technical | |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Air Force Office of Scientific Research 801 N. Randolph St., Room 732 Arlington, Virginia 22203-1977 | | | | 10. SPONSOR/MONITOR'S ACRONYM(S) AFOSR NI/DURIP | |
| | | | | 11. SPONSORING/MONITORING AGENCY REPORT NUMBER | |
| 12. DISTRIBUTION AVAILABILITY STATEMENT Unclassified Unlimited | | | | | |
| 13. SUPPLEMENTARY NOTES | | | | | |
| 14. ABSTRACT (Executive Summary Attached) | | | | | |
| 15. SUBJECT TERMS | | | | | |
| 16. SECURITY CLASSIFICATION OF: | | | 17. LIMITATION OF ABSTRACT | 18. NUMBER OF PAGES | 19a. NAME OF RESPONSIBLE PERSON |
| a. REPORT | b. ABSTRACT | c. THIS PAGE | | | Leonard J. Brillson |
| U | U | U | UU | 2 | 19b. TELEPHONE NUMBER (Include area code) 614-292-8015 |

Executive Summary

We have acquired an Auger Electron Spectroscopy Microprobe Analysis System for elemental and bonding analysis of electronic materials, equipped with specimen stage, ion beam depth analyzer, and ultrahigh vacuum (UHV) preparation chamber interfaced to an existing UHV scanning electron microscope. The specific equipment purchased is: JEOL USA, Inc. Auger Electron Spectroscopy Depth Profiling Hardware and Software for the JAMP-7800F. Its acquisition enhances a number of DOD-funded programs and student training that involve development of high power and high frequency electronic materials with superior performance, especially improving the state-of-the-art and availability of radiation-tolerant semiconductor electronics for applications in the space environment.investigators.

Final Report on AFOSR F49620-00-1-0247 DURIP

**ACQUISITION OF A NANOMETER - SCALE AUGER
ELECTRON SPECTROSCOPY ANALYTICAL MICROPROBE**

Air Force Office of Scientific Research

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We have acquired an Auger Electron Spectroscopy Microprobe Analysis System for elemental and bonding analysis of electronic materials, equipped with specimen stage, ion beam depth analyzer, and ultrahigh vacuum (UHV) preparation chamber interfaced to an existing UHV scanning electron microscope. Its acquisition enhances a number of DOD-funded programs that involve development of high power and high frequency electronic materials with superior performance, especially improving the state-of-the-art and availability of radiation-tolerant semiconductor electronics for applications in the space environment. This facility establishes the leading facility for nanometer – scale chemical and electronic structure characterization at any university and at modest cost. The proposed instrumentation has been combined with a 25 keV scanning electron microscope employed for high spatial and energy resolution cathodoluminescence spectroscopy. This facility is unique in its capability to detect optical emission from electronic defects and band structure extending from the surface into the bulk of semiconductor and insulator multilayer structures with nanoscale resolution. The combination of facilities is providing state-of-the-art correlations of local chemical composition, bonding, and potential with electronic traps within the field and gate oxides of CMOS device structures and at GaN and GaAs transistor interfaces. The facility has already been used extensively to study the electronic properties of advanced semiconductors such as GaN, AlGaN, and SiC, their heterojunctions and their interfaces with metals. This instrument will also benefit a number of other AFOSR investigators studying corrosion inhibitors for high strength Al alloys in aerospace applications. It has been installed in a multidisciplinary laboratory and available to researchers from several departments at Ohio State, Vanderbilt University, North Carolina State University, UC Santa Barbara, Ohio University, the University of Cincinnati, as well as the Air Force Research Laboratories at Wright – Patterson AFB. Hence, the acquisition of this instrumentation provides world-class and unique facilities in the area of electronic materials characterization to a diverse community of AFOSR- and other DOD-funded